TABLE 4.10.1–1.—*Sources, Potential Health Effects, and Strategies for the Prevention and Control of Air Pollutants*[a]

Examples of Sources	Health and Related Effects[b]	Local Concerns	Prevention and Control Strategies
Ozone			
Ozone is formed when POCs and nitrogen oxides react in the presence of sunlight. POC sources include any source that burns fuels (e.g., gasoline, natural gas, wood, oil), solvents, petroleum processing and storage, pesticides, and many consumer products (paint, ink, etc.). The greatest source of ozone precursors is the automobile. In the Bay Area, more than 50 percent of the POCs and nitrogen oxides come from cars and trucks.	Breathing difficulties, lung tissue damage, damage to rubber and some plastics. Contributes to visibility reduction.	Ozone is a major concern locally. Both the Bay Area and San Joaquin Valley air basins have been designated as nonattainment for state and Federal ozone standards. San Joaquin has been further ranked as serious, the highest, or most problematic, ranking. After having been designated as attainment for the 1-hour ozone standard, more recently the Bay Area was redesignated to nonattainment (August 1998), but has not yet been further ranked.	Reduce motor vehicle POCs and nitrogen oxide emissions through emissions standards, reformulated fuels, inspections programs, and reduced vehicle use. Limit POC emissions from commercial operations and consumer products. Limit POC and nitrogen oxide emissions from industrial sources such as power plants and refineries. California's automobile emissions control program, together with the district's regulatory controls, has sharply reduced ozone levels.
Carbon Monoxide			
Any source that burns fuel such as automobiles, trucks, heavy construction equipment and farming equipment, and residential heaters and stoves. Almost 70 percent of the Bay Area's carbon monoxide comes from motor vehicles, and a large fraction of the remainder is from burning wood in fireplaces and woodstoves.	Chest pain in heart patients, headaches, reduced mental alertness, death at very high levels.	Both districts are in attainment of the state and Federal ambient air quality standards. Maximum levels monitored in Livermore are approximately one-third of the standard.	Control motor vehicle and industrial emissions. Use oxygenated gasoline during winter months. Conserve energy.

TABLE 4.10.1–1.—*Sources, Potential Health Effects, and Strategies for the Prevention and Control of Air Pollutants*[a] *(continued)*

Examples of Sources	Health and Related Effects[b]	Local Concerns	Prevention and Control Strategies
		Nitrogen Dioxide	
Automobiles, trucks, heavy construction equipment and farming equipment, and residential heaters and stoves.	Lung irritation and damage. Reacts in the atmosphere to form ozone and acid rain. Contributes to brown haze. At higher concentrations, damage has been noticed in sensitive crops such as beans and tomatoes.	It is a major contributor to ozone formation. Both districts are in attainment of the state and Federal ambient air quality standards; however, at concentrations experienced in the Bay Area, nitrogen dioxide can be seen as a brown haze on days with otherwise good visibility.	Control motor vehicle and industrial combustion emissions.
		Sulfur Dioxide and Sulfates	
Coal- or oil-burning power plants and industries, refineries, and diesel engines.	Increases lung disease and breathing problems, particularly for asthmatics. Reacts in the atmosphere to form acid rain. Sulfates also contribute to reduced visibility. Sulfates and sulfuric acid can damage vegetation and affect the health of both humans and animals.	Both districts are classified attainment of the state and Federal ambient air quality standard for sulfur dioxide and the state ambient air quality standard for sulfates. Maximum levels monitored in Livermore are approximately one-third of the standard. No state or Federal excesses have been recorded at district monitoring stations since 1976.	Limit use of high sulfur fuels (e.g., use low sulfur reformulated diesel or natural gas).

TABLE 4.10.1–1.—*Sources, Potential Health Effects, and Strategies for the Prevention and Control of Air Pollutants*[a] *(continued)*

Examples of Sources	Health and Related Effects[b]	Local Concerns	Prevention and Control Strategies
Particulate Matter			
Coarse particles (referred to as PM_{10}, i.e., particle diameter of 10 microns or less)[c] come from sources such as windblown dust from the desert or agricultural fields and dust kicked up on unpaved roads by vehicle traffic. The major human-generated (anthropogenic) sources in the Bay Area include motor vehicle travel over paved and unpaved roads, demolition and construction activity, and wood burning in fireplaces and stoves. Agricultural operations and burning also contribute significantly to particulate concentrations in rural areas. PM_{10} emissions are expected to increase in future years. Fine particles ($PM_{2.5}$) are generally emitted from activities such as industrial and residential combustion and from vehicle exhaust. $PM_{2.5}$ are also formed in the atmosphere when gases such as sulfur dioxide and nitrogen oxide, and volatile organic compounds, emitted by combustion activities, are transformed by chemical reactions in the air.	PM_{10} can accumulate in the respiratory system and aggravate health problems such as asthma. $PM_{2.5}$ is more likely to be associated with premature death and increased hospital admissions and emergency room visits (primarily with elderly and individuals with cardiopulmonary disease); increased respiratory symptoms and disease (primarily children and individuals with cardiopulmonary disease such as asthma); decreased lung function (particularly in children and individuals with asthma); and alterations in lung tissue and structure and in respiratory tract defense mechanisms. $PM_{2.5}$ is also linked with reduced visibility (e.g., obscures mountains and other scenery) because it scatters and absorbs light, reduces airport safety, and contributes to surface soiling.	The Bay Area air district is classified as nonattainment with respect to California standards, attainment for the annual Federal PM_{10} standard, and unclassified for $PM_{2.5}$ and 24-hour PM_{10} Federal standards. The San Joaquin Valley air district is classified as nonattainment for state standards and as a serious nonattainment area for Federal PM_{10}. The designation for Federal $PM_{2.5}$ standard has not yet been determined.	Reduce combustion emissions from motor vehicles, equipment, industries, and agriculture and residential burning. Precursor controls, like those for ozone, reduce $PM_{2.5}$ formation in the atmosphere. Control dust sources, industrial particulate emissions, and wood burning stoves and fireplaces. Reduce secondary pollutants that react to form PM_{10}.

TABLE 4.10.1–1.—*Sources, Potential Health Effects, and Strategies for the Prevention and Control of Air Pollutants*[a] *(continued)*

Examples of Sources	Health and Related Effects[b]	Local Concerns	Prevention and Control Strategies
		Lead	
Metal smelters, resource recovery, leaded gasoline, deterioration of lead paint.	Learning disabilities and brain and kidney damage.	No specific information. Areas are in attainment of both state and Federal ambient air quality standards.	Control metal smelters, no lead in gasoline. Replace leaded paint with non-lead substitutes.
		Hydrogen Sulfide	
Geothermal power plants, petroleum production and refining, sewer gas.	Nuisance odor (rotten egg smell), headache and breathing difficulties at higher concentrations.	No specific information. Both areas are unclassified with respect to the state ambient air quality standard.	Control emissions from geothermal power plants, petroleum production and refining, sewers, and sewage treatment plants.
		Toxic Air Contaminants	
Cars and trucks, especially diesels; industrial sources such as chrome plating; neighborhood businesses, such as dry cleaners and service stations; and building materials and products. Over 50 percent of the public's total exposure to toxic air contaminants in the Bay Area comes from the carcinogens benzene and 1,3-butadiene, two organic compounds found in automobile exhaust.	Cancer; chronic eye, lung, or skin irritation; and neurological and reproductive disorders.	Within the city of Livermore, there are approximately 20 facilities that must report emissions of toxic air contaminants, i.e., emissions exceeding de minimis levels. The individual excess cancer risk due to average ambient concentrations of toxic air contaminants measured in the Bay Area during 2000 is approximately 170 in a million (See Section 4.10.2.2). Toxic air contaminants are regulated under various state and local programs.	See general discussions under ozone and particulate matter and other pollutant subgroups (lead, hydrogen sulfide, etc.) for control of gaseous and particulate air pollutants.

TABLE 4.10.1–1.—*Sources, Potential Health Effects, and Strategies for the Prevention and Control of Air Pollutants*[a] *(continued)*

Examples of Sources	Health and Related Effects[b]	Local Concerns	Prevention and Control Strategies
Stratospheric Ozone-Depleting Substances			
Non-POCs include methylene chloride, 1,1,1-trichloroethane, halons and the family of chemicals referred to as freons or chlorofluorocarbons, and chlorine and bromine compounds. Refrigerants, air conditioners, fire suppressants, certain aerosols, and solvents.	Increased incidence of harmful health consequences of ultraviolet radiation, particularly squamous cell carcinomas of the skin.	No additional local concerns stratospheric on ozone depletion.	Substitute formulations with lower ozone-depleting potential. Good maintenance.

Source: See table notes.

[a] Extracted from information provided in multiple sources including: EPA Ozone Depletion and Climate Protection Partnerships Division Websites (EPA 2002b); EPA Revised Particulate Matters Fact Sheet (EPA 1997); CARB Website Fact Sheets on Air Pollution and Air Pollution and Health (CARB 2002a, CARB 2002b); and BAAQMD Website, Attainment Website Status, General Pollutant Information and Toxic Air Contaminant Control Program Annual Report, and CEQA Guidelines for Assessing the Air Quality Impacts of Projects and Plans (BAAQMD 2003, 2002, 2001, 1999); and SJVUAPCD Website Attainment Status (SJVUAPCD 2002).

[b] Although air pollutants can cause health problems for everyone, certain people are especially vulnerable. These "sensitive populations" include children, the elderly, exercising adults, and those suffering from asthma or bronchitis. Of greatest concern are recent studies that link PM_{10} exposure to the premature death of people who already have heart and lung disease, especially the elderly.

[c] One micron (also referred to as a micrometer or µm) = 1×10^{-6} meters.

BAAQMD = Bay Area Air Quality Management District; CARB = California Air Resources Board; CEQA = *California Environmental Quality Act* of 1970; EPA = U.S. Environmental Protection Agency; POC = precursor organic compounds; SAAQS = State Ambient Air Quality Standard